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PATENT TRADEMARK OFFICE

Docket No: 1313/1F022-US1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Harding et al.

Serial No.: 09/<sup>557</sup>~~577~~,804

Art Unit: 1623

Confirmation No.: 8941

Filed: April 25, 2000

Examiner: E. White

For: CELLULOSE ETHERS AND METHOD OF PREPARING THE SAME

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APPEAL BRIEF

Hon. Commissioner of  
Patents and Trademarks  
Washington, DC 20231

Sir:

Appellants submit this Appeal Brief in triplicate as required by 37 C.F.R.

§1.192. A check in the amount of \$320.00 for the required fee pursuant to 37 C.F.R. §§1.192 and 1.17(c) for filing this appeal brief is enclosed. A Notice of Appeal was filed on November 15, 2002.

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### **REAL PARTY IN INTEREST**

The real party in interest is BKI Holding Corporation.

### **RELATED APPEALS AND INTERFERENCES**

Appellants' attorney is not at this time aware of any related appeals and/or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

### **STATUS OF CLAIMS**

Although claims 1-73 are pending, claims 1-38, 40-59, and 65-73 have been withdrawn from consideration. Claim 64 has been canceled by the accompanying Amendment. Claims 39 and 60-63, which are shown in the appendix, are on appeal.

### **STATUS OF AMENDMENTS**

No amendments prior to the filing of this Appeal Brief have been submitted by Appellant subsequent to the Final Office Action of September 18, 2002. Appellant submits herewith an Amendment canceling claim 64.

### **SUMMARY OF INVENTION**

The present invention relates to a novel carboxymethyl cellulose (CMC) having significantly higher viscosities than similar CMC's produced by prior art methods. The CMC of the present invention is prepared by:

1. Mercerizing a starting cellulose pulp;

2. Recovering the mercerized cellulose pulp (to yield cellulose II);
3. Converting the cellulose pulp to CMC.

The mercerized and recovered cellulose pulp (i.e., cellulose II) can be converted to CMC by (1) alkalating the cellulose pulp to form alkali cellulose and (2) etherifying the alkali cellulose to yield CMC.

### **ISSUES**

Are claims 39 and 60-63 patentable under 35 U.S.C. §103(a) over European Patent Publication No. 879,827-A1 (EP '827)?

### **GROUPING OF CLAIMS**

Claims 39 and 60-63 stand or fall together.

### **ARGUMENT**

Claims 39 and 60-63 stand rejected under 35 U.S.C. §103(a) as obvious over EP '827. The Examiner contends that:

(1) EP '827 discloses CMC prepared by the process recited in the pending claims (See page 4, paragraph no. 7, of the September 8, 2002 Office Action); and

(2) “[t]he instantly claimed [CMC], per se, does not appear to indicate characteristics that make the product different and therefore patentable over the [CMC] product of [EP '827]” (See the paragraph bridging pages 3 and 4 of the September 8, 2002 Office Action).

Contrary to the Examiner's assertions, the process and CMC of the present invention are different than those described in EP '827.

**I. The Process of the Present Invention is Different Than That Described in EP '827**

A brief review of the chemistry and properties of cellulose and cellulose derivatives will put the invention of the appealed claims in perspective and show how it is distinguishable from the prior art cited in the rejection. Mercerization is the swelling action of concentrated alkali, usually sodium hydroxide, on cellulose. Since cellulose is not soluble in water, the reaction is conducted as a heterogeneous reaction upon an aqueous slurry of cellulose fibers in water. The complete range of temperature and concentration conditions for mercerization with sodium hydroxide have been exhaustively studied by X-ray methods on mercerized and recovered cellulose. See Cellulose and Cellulose Derivatives, Volume V of HIGH POLYMERS, edited by Emil Ott, pages 272-345 on Mercerization, Interscience Publisher, Inc., New York, NY, 1943 (Exhibit 1). See especially, Ott at 273-274.

Very interesting is a description of changes to the microscopic structure of cellulose fibers. In a section of Ott starting at page 338 written by E. I. Valko more than fifty years ago, the changes to cotton fiber were described as follows:

Immediately before the ripe boll burst open and exposes its flocks of cotton to the atmosphere, the fibers are tubular, with the hollow center (the "lumen") occupying a considerable portion of the cross section. No convolutions or twists are present, and the cross sections approach very closely to an elliptical or even circular form. On exposure to the air, the fiber dries out quickly and collapses to form a flat, convoluted ribbon. Commercial cotton hair is in this form.

When the cotton hair is brought into mercerizing solution, it begins to swell at once. In a few seconds it become elliptical, and, on further swelling, the cross section becomes almost circular. The diameter of this section is at least 25 to 30% greater than the width of the collapsed fiber.<sup>33</sup> . . . . During the mercerization process, the cellulose of the walls swells inwardly. After the alkali treatment and during the washing and drying, the cross section shrinks. During this shrinkage, the hair retains the same circular form, but the shrinkage proceeds uniformly toward the axis and the lumen does not recover its original size. . . . . By the strong swelling, the arrangement which was responsible for the collapse of the native hair is broken up, and the cylindrical form is retained upon subsequent drying.

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<sup>33</sup> M. A. Calvert and F. Summers, *J. Textile Inst.*, 16 T233 (1925).

Although many of the literature discussions of mercerization talk of it as being the treatment with alkali, it must be noted that physical studies of the effects of mercerization have all been performed on cellulose, which, after treatment with alkali, has been washed and dried. Washing removes the alkali. More recent discussions talk in terms of an irreversible change from native, amorphous cellulose I to cellulose II or crystalline cellulose.

Sarko et al. (Exhibit 2) have studied the conversion of the crystal structure of native cellulose (cellulose I) to that of cellulose II through a series of crystalline intermediate alkali cellulose complexes. See Crystalline Alkali-Cellulose Complexes as Intermediates During Mercerization by Sarko et al, page 169-177 written as Chapter 9 of The Structures of Cellulose, Rajai H. Atalla, Editor, ACS Symposium Series Volume 340, American Chemical Society, Washington, DC, 1987. "Removing the NaOH from the structure through washing with water removes the energy-lowering electrostatic field. This results in a conversion of the structure to the only energy-lowering one that is available to it - a twofold helical, interchain

hydrogen-bonded sheet structure.” Sarko at page 176. While treatment with alkali to produce an alkali cellulose occurs in mercerization, it is the washing to remove the alkali which produces the final irreversible transformation to cellulose II.

“Mercerization is the name given to the conversion accomplished by swelling native cellulose fibres in concentrated sodium hydroxide solution. Although no dissolution occurs, the swelling allows for reorganization of the chains, and cellulose II results when the swelling agent is removed.” Kolpak et al., *Polymer*, 19:123-131, 123 (Feb. 1978).

In the derivatization process to form a carboxymethyl cellulose (CMC), the first step is the formation of an alkali cellulose, a heterogeneous reaction performed on a slurry of the starting cellulose. This is followed by derivatization of the cellulose, at which point it may dissolve. Derivatization performed on an alkali cellulose produced from native cellulose (cellulose I) is described many times in the prior art and in the cited reference used to reject the instant claims. However, that alkali cellulose does not contain cellulose II.

In contrast, the CMC of this invention is produced by derivatization of cellulose II, which has been produced by mercerization and recovery of the pulp prior to formation of an alkali cellulose in the derivatization process. Therefore, the prior art process is not the same as the claimed process, and, as the data cited below from the written description shows, the CMC of the appealed claims is not the same as the prior art CMC.

EP ‘827 teaches that CMC may be prepared by (a) mercerizing ground cellulose with aqueous sodium hydroxide in alcohol and (b) reacting, or etherifying, the mercerized cellulose with monochloroacetic acid to form the CMC (page 2, lines 18-27). There is no washing step or recovery step following mercerization and prior to derivatization with monochloroacetic acid in the process of the reference.

In contrast, the processes recited in pending claims 39 and 60-63 generally include:

- (a) obtaining mercerized and recovered cellulose pulp (cellulose II);
- and
- (b) converting the mercerized and recovered cellulose pulp into CMC.

The cellulose pulp obtained in step (a) has been mercerized with sodium hydroxide and recovered by removing the sodium hydroxide in the cellulose pulp to convert it from cellulose I to cellulose II.

EP '827 does not disclose or suggest recovering the cellulose pulp after the mercerization step and prior to converting the mercerized pulp to CMC. For instance, in Example 1 of EP '827, after mercerization was performed by adding aqueous sodium hydroxide, the mercerized pulp was etherified by adding monochloroacetic acid (page 3, lines 4-10) in the presence of the sodium hydroxide to yield CMC. The mercerized pulp was not recovered prior to etherifying it. Therefore, the etherification reaction of the reference was performed on cellulose I, not on cellulose II.

EP '827 does not disclose or suggest mercerizing and recovering the cellulose pulp before alkalating and etherifying it to form CMC. Rather in EP '827, the cellulose pulp is mercerized and alkalated with sodium hydroxide in a single step and then etherified with monochloroacetic acid. In contrast, Examples 1-13 of the present application show CMC prepared by treating cellulose pulp with sodium hydroxide twice. More specifically, CMC was

prepared in Examples 1-7 and 9-13 by mercerizing cellulose pulp with sodium hydroxide, recovering it, alkalating it with sodium hydroxide, and etherifying it.

## **II. The CMC Product Produced By the Process of the Present Invention is Different Than That Produced By the Process in EP '827**

The viscosity of a CMC prepared by any process is dependent, inter alia, on the starting cellulose pulp. For example, CMC produced from cotton linters pulp generally has a higher viscosity than that prepared under the same process conditions from southern hardwood kraft pulp.

For any given starting cellulose pulp, the process of the present invention yields a CMC having a significantly higher solution viscosity than a CMC produced by the typical prior art method of preparing CMC by simply alkalating and etherifying cellulose pulp as described in EP '827. EP '827 teaches a method of preparing CMC with a particular solvent system which results in greater chemical efficiency and "a higher-quality product which manifests itself, for example, as a clearer aqueous solution of the product and improved stability of the aqueous solution" (page 2, lines 31-41, of EP '827). While this may be so, it is still a CMC derived from cellulose I.

Tables 1-4 below show the viscosity of CMC's prepared as described in Examples 1-5, 7, 9, and 10 of the present application from various starting cellulose pulps, including never-dried and re-wetted cellulose pulps which had been converted from cellulose I to cellulose II by mercerization and recovery. The control for each example was prepared by the same procedure as the example on the native cellulose (cellulose I) which was not mercerized and recovered before being alkalated and etherified.



Table 1

CMC Derived from Cotton Linter Pulp				
Example No. in the present application	Concentration of NaOH (%)	1% Solution Viscosity (cP)	Control's 1% Solution Viscosity (cP)	Percentage Change in Viscosity
1 (Never-dried) <sup>1</sup>	14	80095	34690	130.89%
	18	83745	34690	141.41%
7 (Never-dried)	18 (Average)	79410	21493	269.47%
7 (Re-wetted dried)	18 (Average)	43453	21493	102.17%
9 (Never-dried)	18	75190	30145	149.43%
10 (Never-dried)	18	55335	25685	115.44%
10 (Never-dried)	18	57190	13920	310.85%

Table 2

CMC derived from Southern Softwood Kraft Pulp				
Example No. in the present application	Concentration of NaOH (%)	1% Solution Viscosity (cP)	Control's 1% Solution Viscosity (cP)	Percentage Change in Viscosity
2 <sup>2</sup>	10	607	586	3.58%
	14	1268	586	116.38%
	18	1147	586	95.73%
3 (Never-dried)	7	679	550	23.45%
	10	1108	550	101.45%
	14	1365	550	148.18%
	18	1472	550	167.64%

<sup>1</sup> The 7 and 10% NaOH treated pulp contained 0% sheet cellulose II and, therefore, was not mercerized.

<sup>2</sup> Table 2 indicates that the 7% NaOH treated pulp contained 0% sheet cellulose II and, therefore, was not mercerized..

Table 3

CMC derived from Southern Hardwood Kraft Pulp				
Example No. in the present application	Concentration of NaOH (%)	1% Solution Viscosity (cP)	Control's 1% Solution Viscosity (cP)	Percentage Change in Viscosity
5 <sup>3</sup>	10	461	230 or 362	100.43% or 27.35%
	14	547	230 or 362	137.83% or 51.10%
	18	923	230 or 362	301.30% or 154.97%

Table 4

CMC derived from Northern Softwood Sulfite Pulp				
Example No. in the present application	Concentration of NaOH (%)	1% Solution Viscosity (cP)	Control's 1% Solution Viscosity (cP)	Percentage Change in Viscosity
4 <sup>4</sup>	10	2037	898 or 1087	126.84% or 87.40%
	14	1835	898 or 1087	104.34% or 68.81%
	18	2608	898 or 1087	190.42% or 139.93%

Tables 1-4 show that CMC's produced by the process of the present invention have significantly higher viscosities than CMC's produced by prior art processes. For example, Table 1 shows that when a cotton linter pulp starting material is mercerized and recovered prior to alkalating and etherifying, the viscosity of the CMC formed increases by at least 102%. Table 4 shows that when a sulfite pulp starting material is mercerized and

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<sup>3</sup> Table 6 indicates that the 7% treated pulp contained only 1% sheet cellulose II.

<sup>4</sup> Table 5 indicates that the 7% treated pulp contained 0% sheet cellulose II and, therefore, was not mercerized.

recovered prior to alkalating and etherifying, the viscosity of the CMC formed increases by at least 104%.

Since the presently claimed CMC's can have significantly higher viscosities than prior art CMC's, applicants respectfully submit that they are different than prior art CMC's, and the CMC's of this invention are nonobvious. *In re Marosi*, 218 USPQ 289 (Fed. Cir. 1983).

Furthermore, prior to the present invention, CMC's having the viscosities recited in claim 63, shown below, as measured according to ASTM D 2196 in an aqueous solution consisting of 1% by weight of CMC, did not exist.

CMC derived from Cotton Linter Pulp	60,000 to 80,000 cP
CMC derived from Southern Softwood Kraft Pulp	1,000 to 1,600 cP
CMC derived from Southern Hardwood Kraft Pulp	1,000 to 3,000 cP
CMC derived from Northern Softwood Sulfite Pulp	1,800 to 3,000 cP

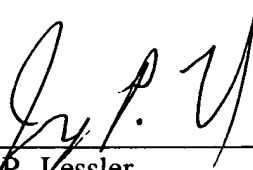
EP '827 does not indicate the type of cellulose pulp from which the CMC disclosed therein is derived. As shown in the tables above, the type of cellulose pulp selected as a starting material has a profound effect on the viscosity of the CMC formed. Therefore, the reference is fatally flawed with regard to its CMC viscosity teachings and cannot render the CMC's of the instant claims obvious.

EP '827 does not state how the 2% viscosity is measured, another fatal flaw in the reference. The viscosities recited in the pending claims are for aqueous solutions containing 1% of CMC. 2% aqueous solutions of the CMC's of the present invention would

have significantly higher viscosities than the 1% viscosities recited in the present application.<sup>5</sup> Without knowing the method used by the reference to measure viscosities, no effective comparison can ever be made. Certainly this reference does not make the CMC's of the instant claims obvious.

For the foregoing reasons, EP '827 fails to render obvious the presently claimed invention and the final rejection of claims 39 and 60-63 should be reversed by the Board. Such a disposition is earnestly solicited.

Respectfully submitted



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<sup>5</sup> Please note that 1 mPas = 1 cP; The viscosities recited in EP '827 are in mPas while those in the present application are recited in cP.

**Appendix**  
**Claims at Issue on Appeal**  
**U.S. Serial No. 09/557,804**

39. (Amended) A carboxymethyl cellulose ether prepared by a method comprising the steps of:

- (a) obtaining mercerized and recovered cellulose pulp; and
- (b) converting the mercerized and recovered cellulose pulp into

carboxymethyl cellulose, wherein the mercerized cellulose pulp in step (a) was mercerized with a cellulose II mercerizing agent, and the mercerized and recovered cellulose pulp has a TAPPI 230 om-89 viscosity greater than 12 cP, when the cellulose pulp is southern softwood kraft.

60. The carboxymethyl cellulose ether of claim 39, wherein the mercerized and recovered cellulose pulp in step (a) is obtained by (i) mercerizing cellulose pulp, (ii) washing, neutralizing, or washing and neutralizing the mercerized cellulose pulp, and (iii) optionally, drying the mercerized cellulose pulp.

61. A carboxymethyl cellulose ether prepared by a method comprising the steps of:

- (a) mercerizing cellulose pulp with a cellulose II mercerizing agent;
- (b) washing, neutralizing, or neutralizing and washing the mercerized cellulose pulp from step (a); and
- (c) alkalating the mercerized cellulose pulp from step (b) to form an

alkali cellulose; and

(d) etherifying the alkali cellulose to form the carboxymethyl cellulose, wherein the mercerized cellulose pulp formed in step (b) has a TAPPI 230 om-89 viscosity greater than 12 cP, when the cellulose pulp is southern softwood kraft.

62. The carboxymethyl cellulose ether of claim 60, wherein the cellulose pulp is a sulfite cellulose pulp.

63. A carboxymethyl cellulose ether prepared by a method comprising the steps of:

- (a) mercerizing cellulose pulp with a cellulose II mercerizing agent;
- (b) washing, neutralizing, or neutralizing and washing the mercerized cellulose pulp from step (a); and
- (c) alkalating the mercerized cellulose pulp from step (b) to form an alkali cellulose; and
- (d) etherifying the alkali cellulose to form the carboxymethyl cellulose,

wherein the mercerized cellulose pulp formed in step (b) has a TAPPI 230 om-89 viscosity greater than 12 cP when the cellulose pulp is southern softwood kraft; and

wherein the carboxymethyl cellulose has a solution viscosity in an aqueous solution consisting of 1% by weight of the carboxymethyl cellulose as measured according to ASTM D 2196 of:

- (i) from about 60,000 to about 100,000 cP, when the cellulose pulp

is cotton linter pulp,

(ii) from about 1,000 to about 1,600 cP, when the cellulose pulp is softwood kraft pulp or hardwood kraft pulp, or

(iii) from about 1,800 to about 3,000 cP, when the cellulose pulp is wood pulp.